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Xu et al.

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(54) **FAN BLADE WITH IMPROVED STRUCTURE**

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F04D 29/30 (2006.01)
F04D 29/28 (2006.01)

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CPC ***F04D 29/30*** (2013.01); ***F04D 29/282*** (2013.01)

(58) **Field of Classification Search**
CPC F04D 29/281; F04D 29/624; F04D 29/388; F04D 29/34; F04D 25/08; F04D 19/002
See application file for complete search history.

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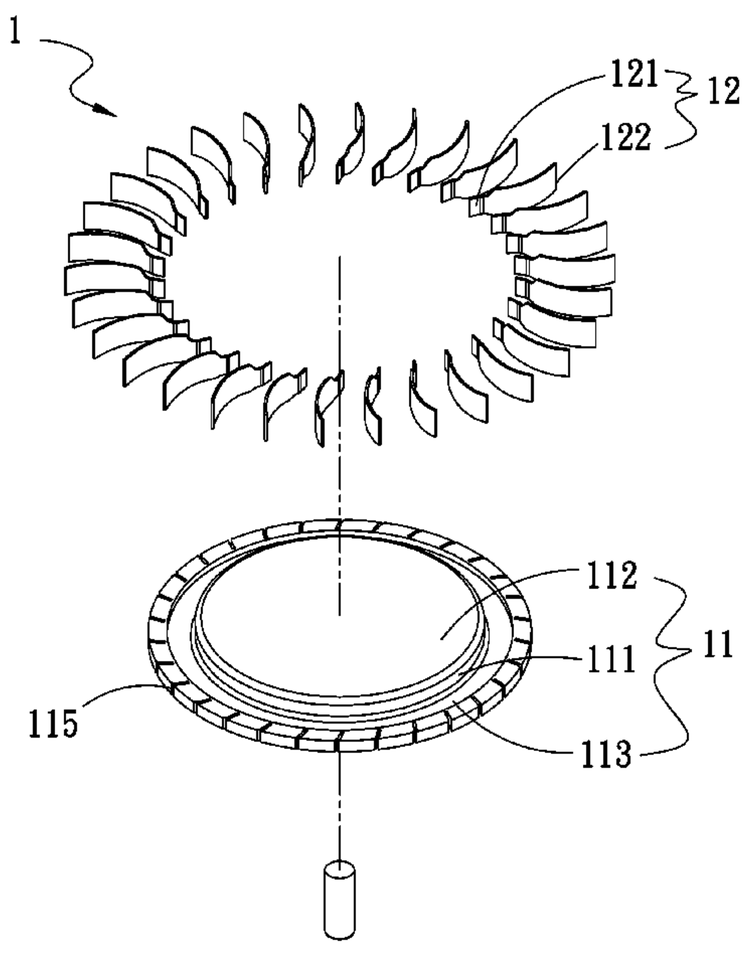
(57) **ABSTRACT**

A fan blade with improved structure includes a hub, a plurality of blades. The hub has a lateral side having two ends, one of which is formed a top side and the other end is extended to form an extended section, and a plurality of connecting slots located on the periphery of the extended section. Each blade has a first end correspondingly engaged in respective connecting slot and a second end. With these arrangements, the fan blade with improved structure can increase structural strength of thin fan blades and be easy to connect the hub to the blades.

9 Claims, 10 Drawing Sheets



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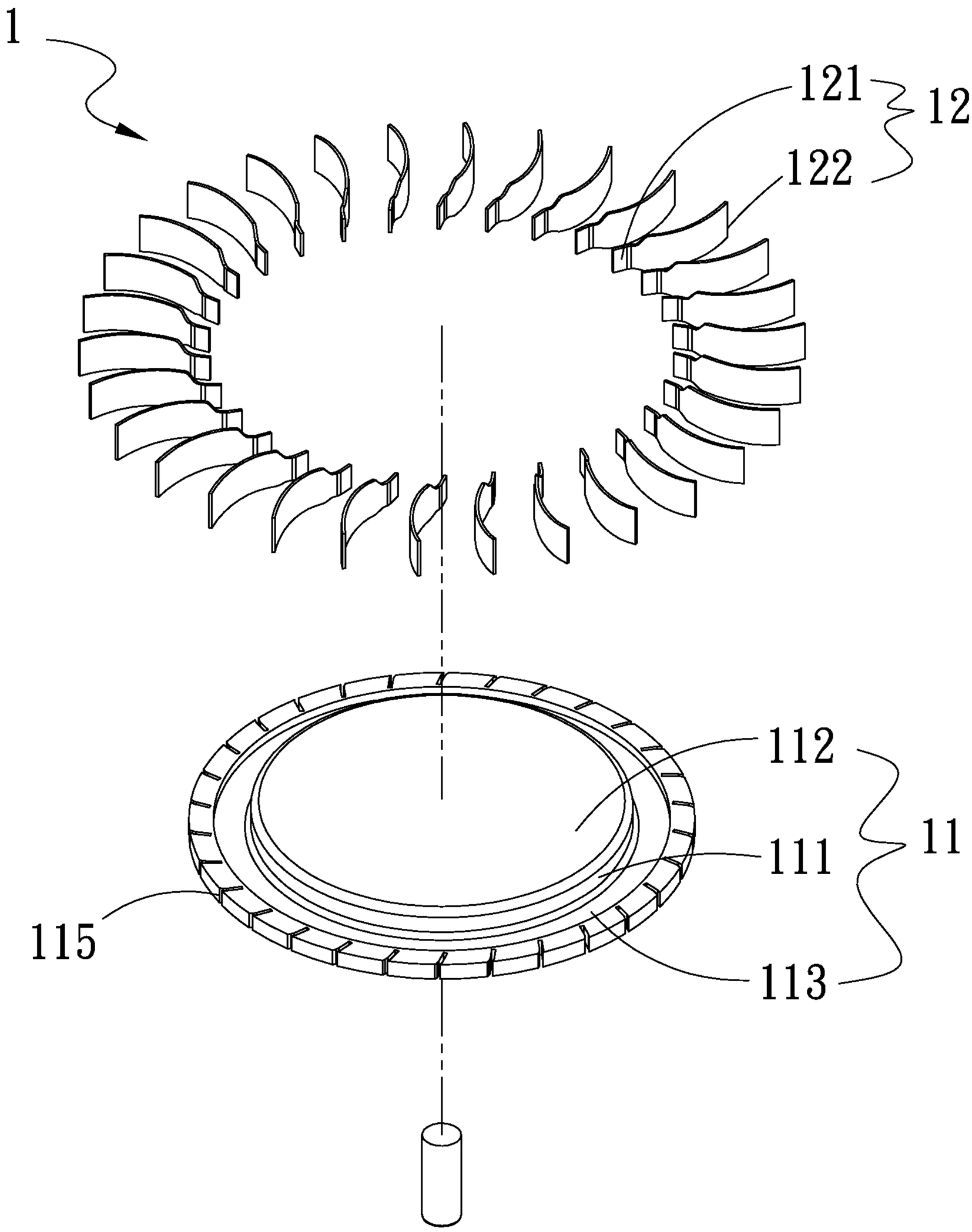

Fig. 1

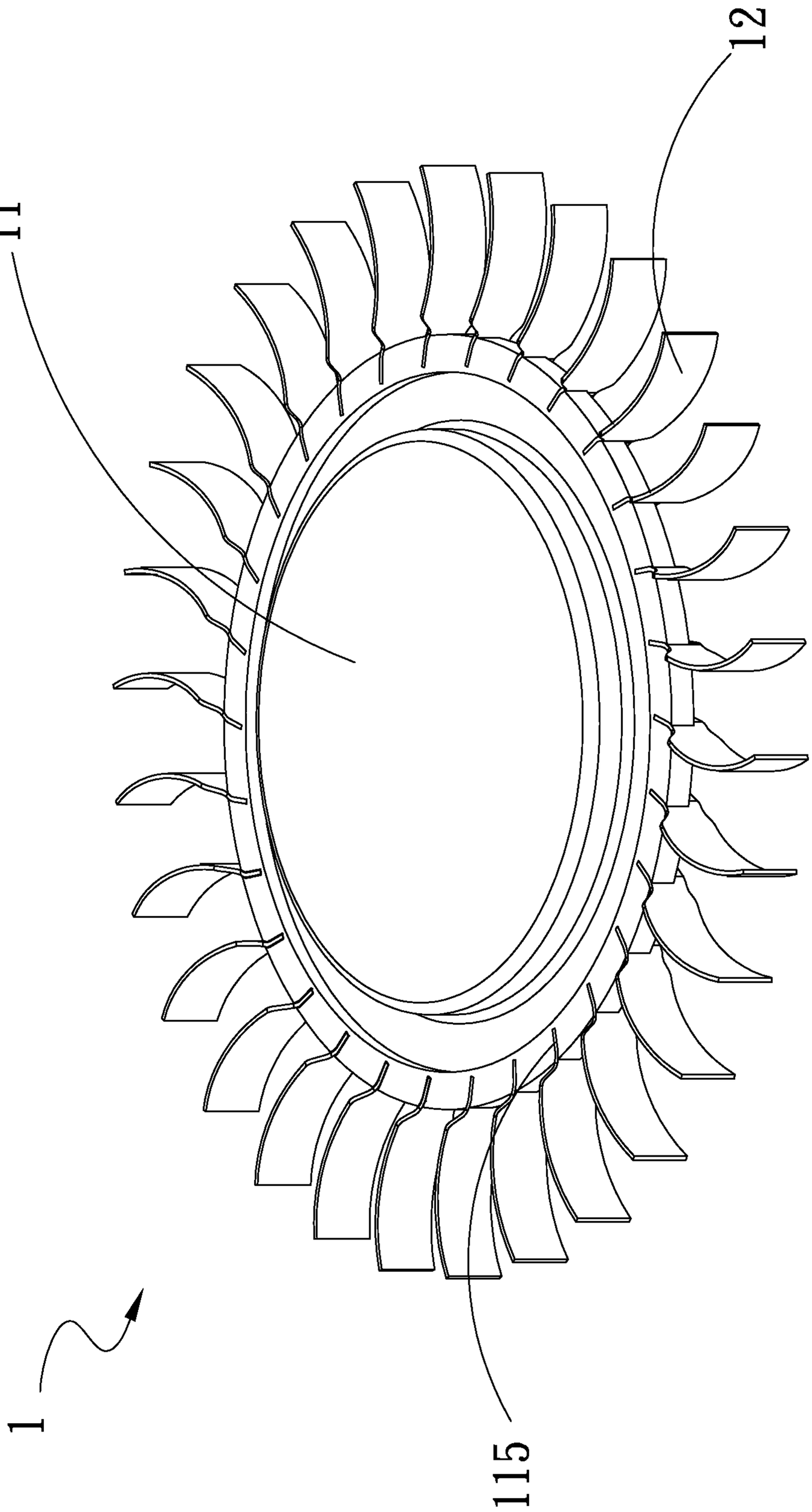

Fig. 2

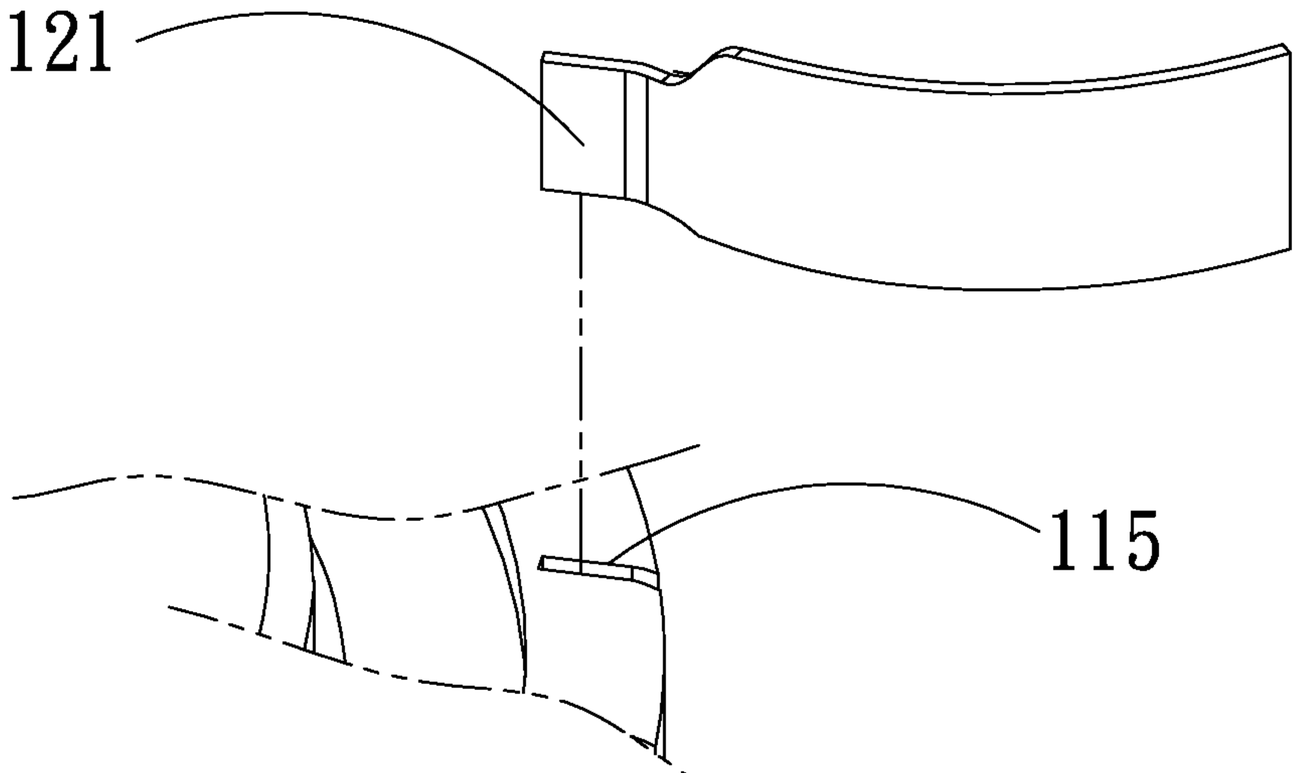

Fig. 3A

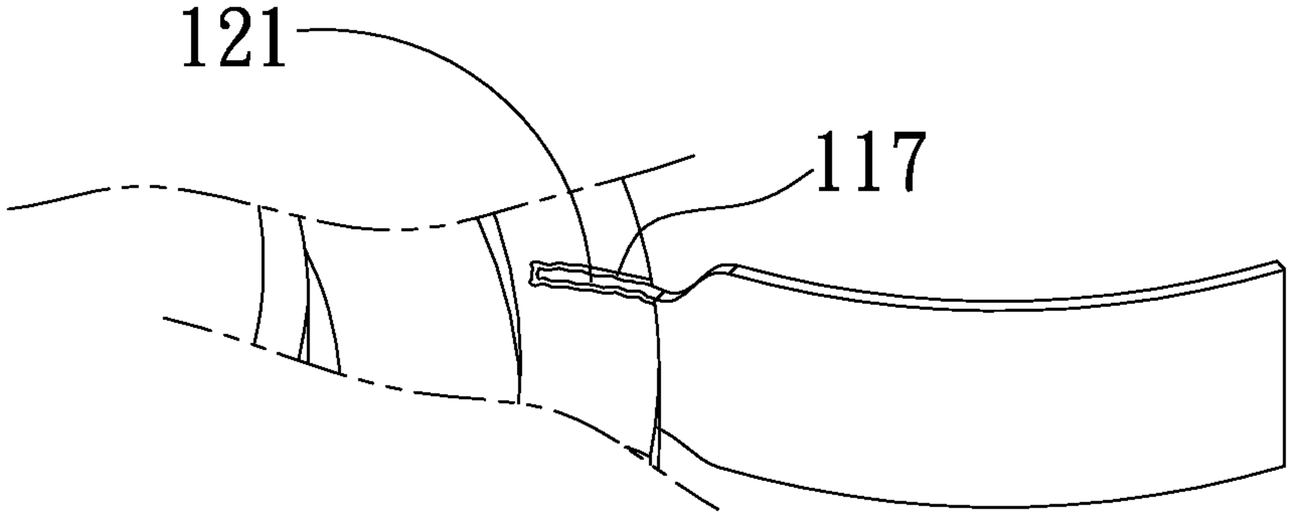

Fig. 3B

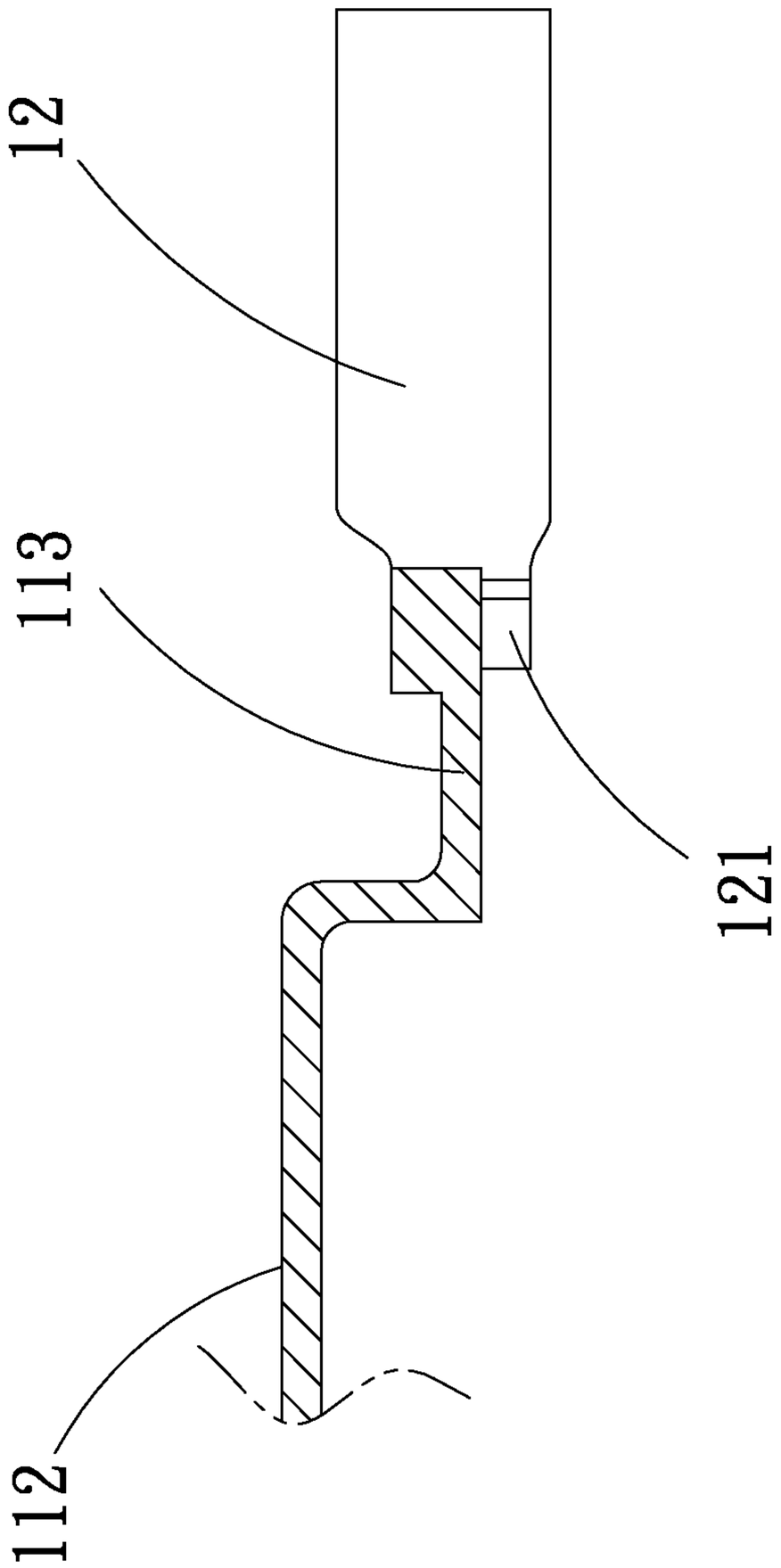

Fig. 4

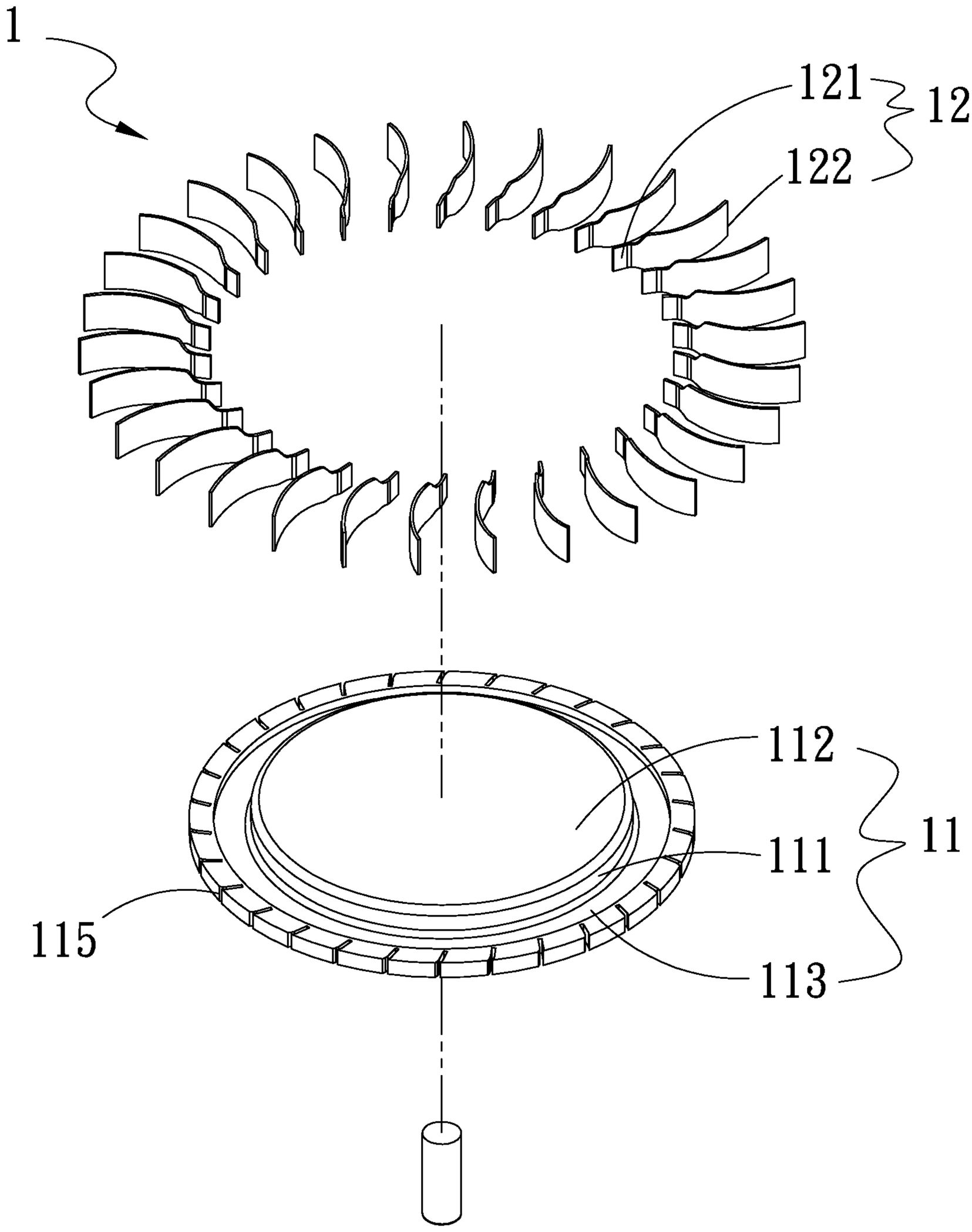

Fig. 5

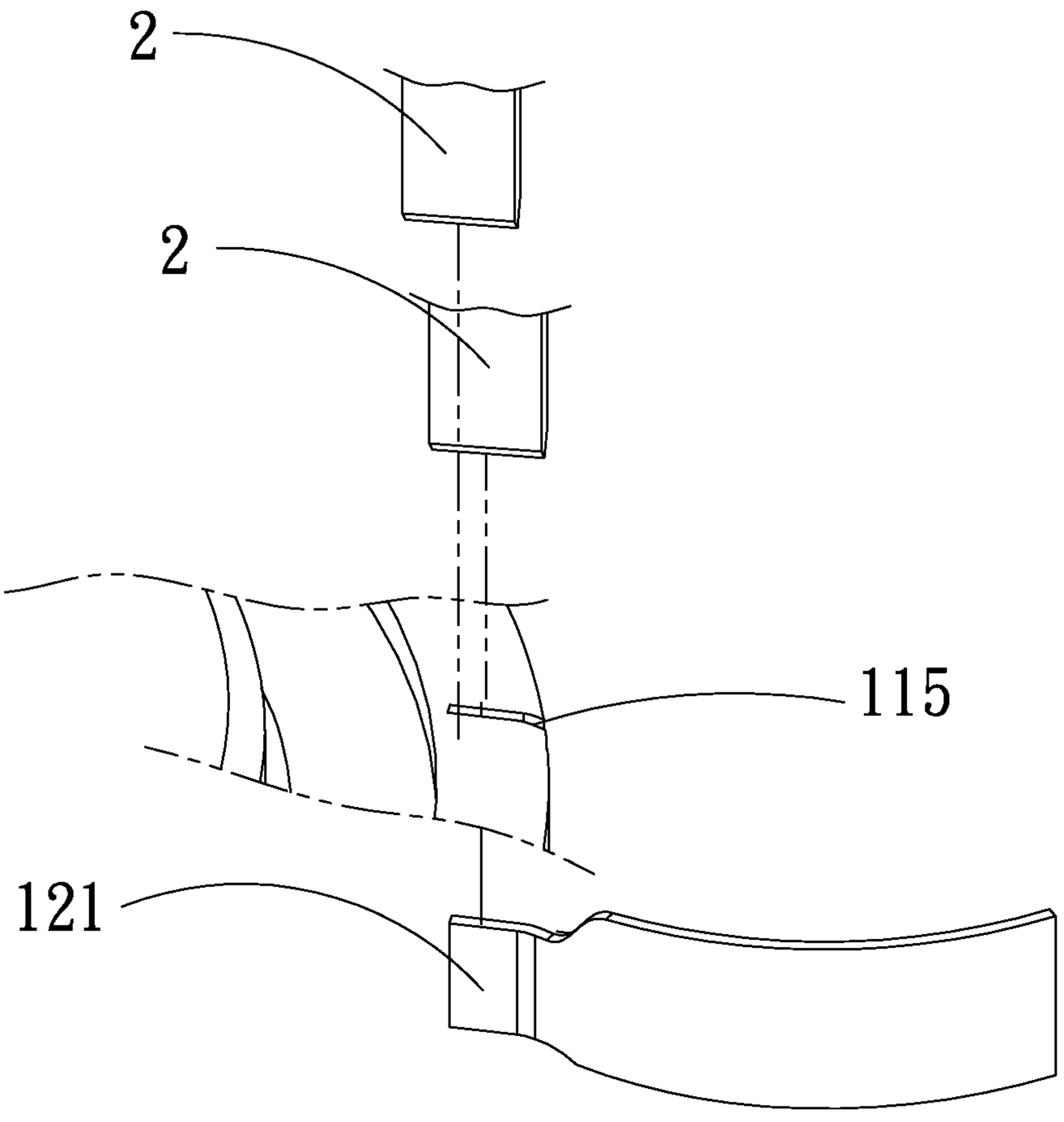

Fig. 6A

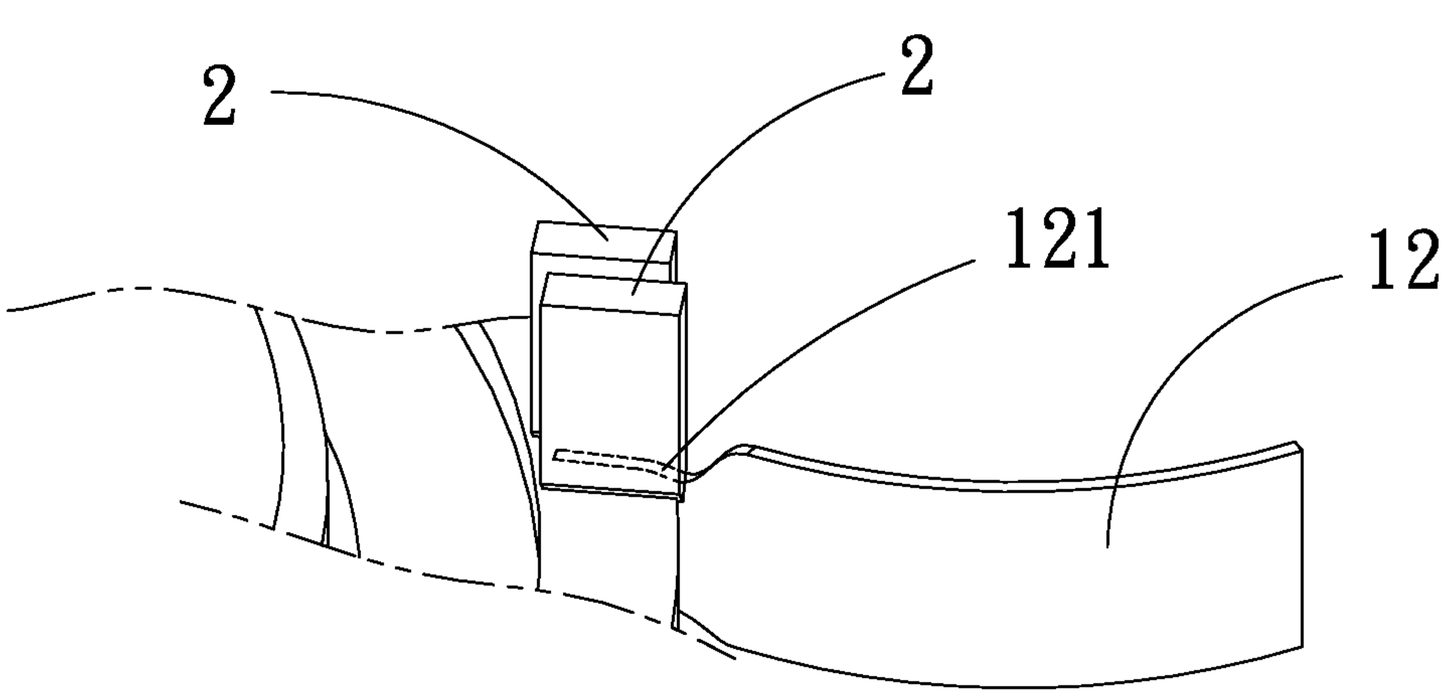

Fig. 6B

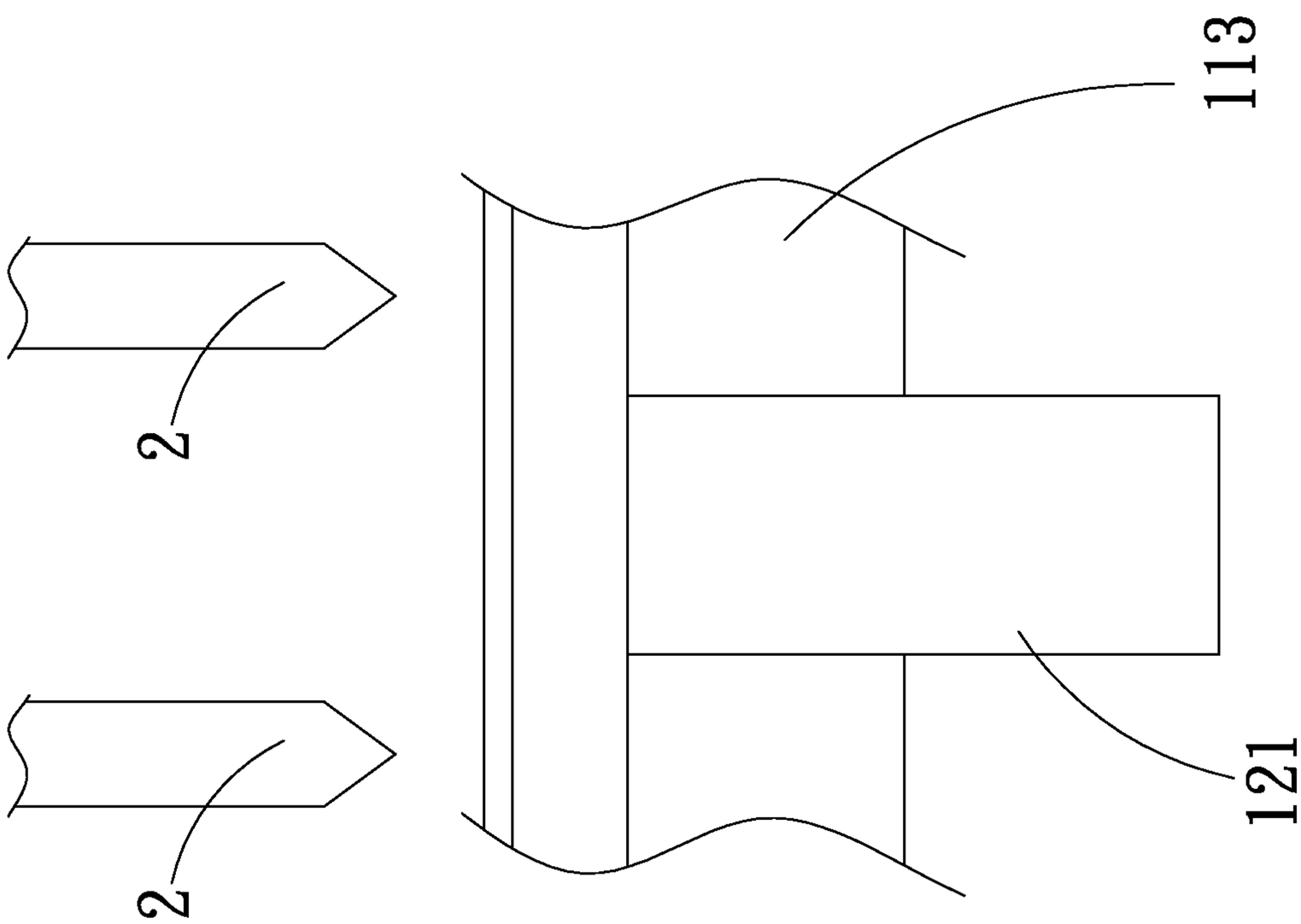

Fig 6C

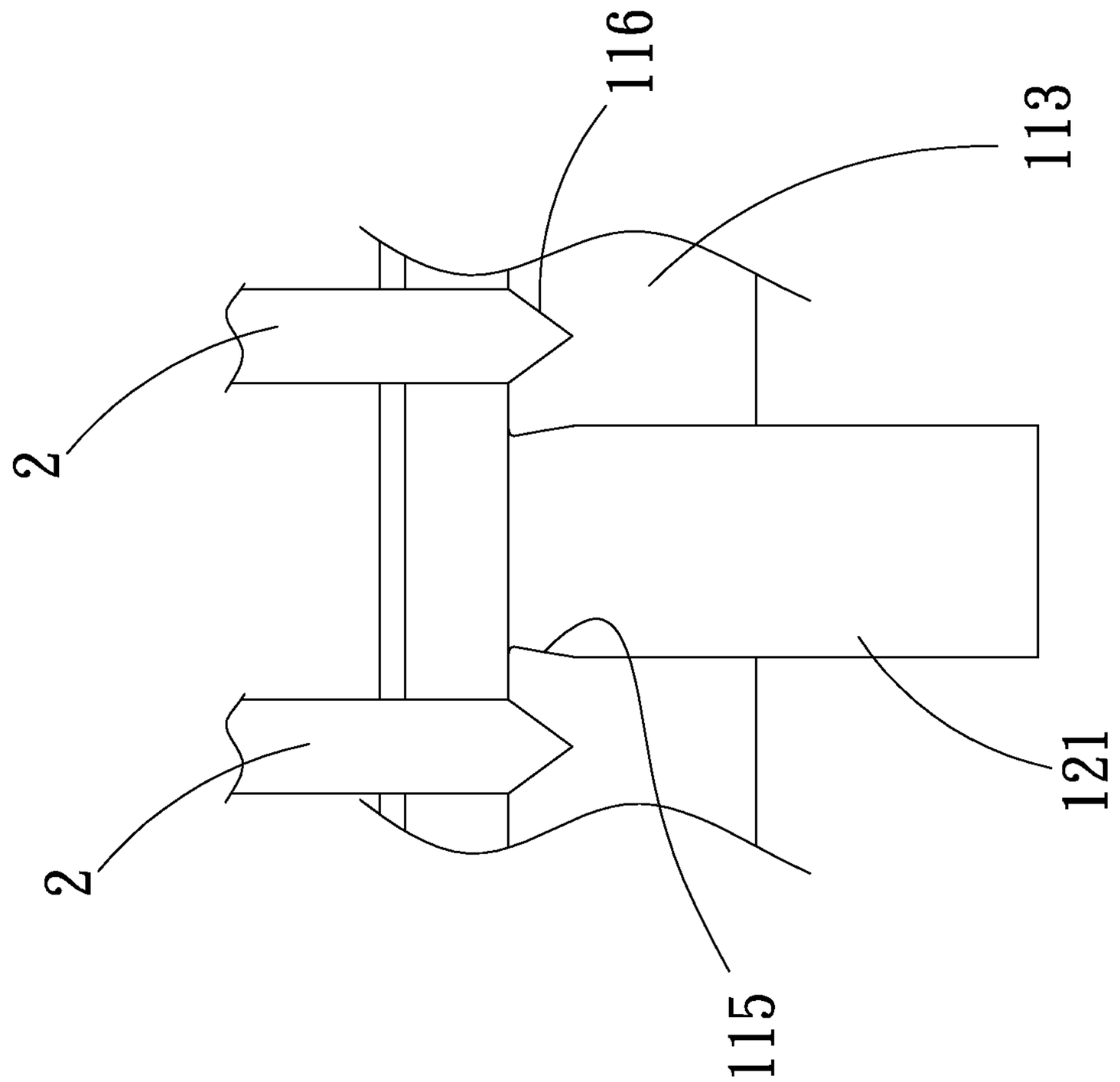

Fig. 6D

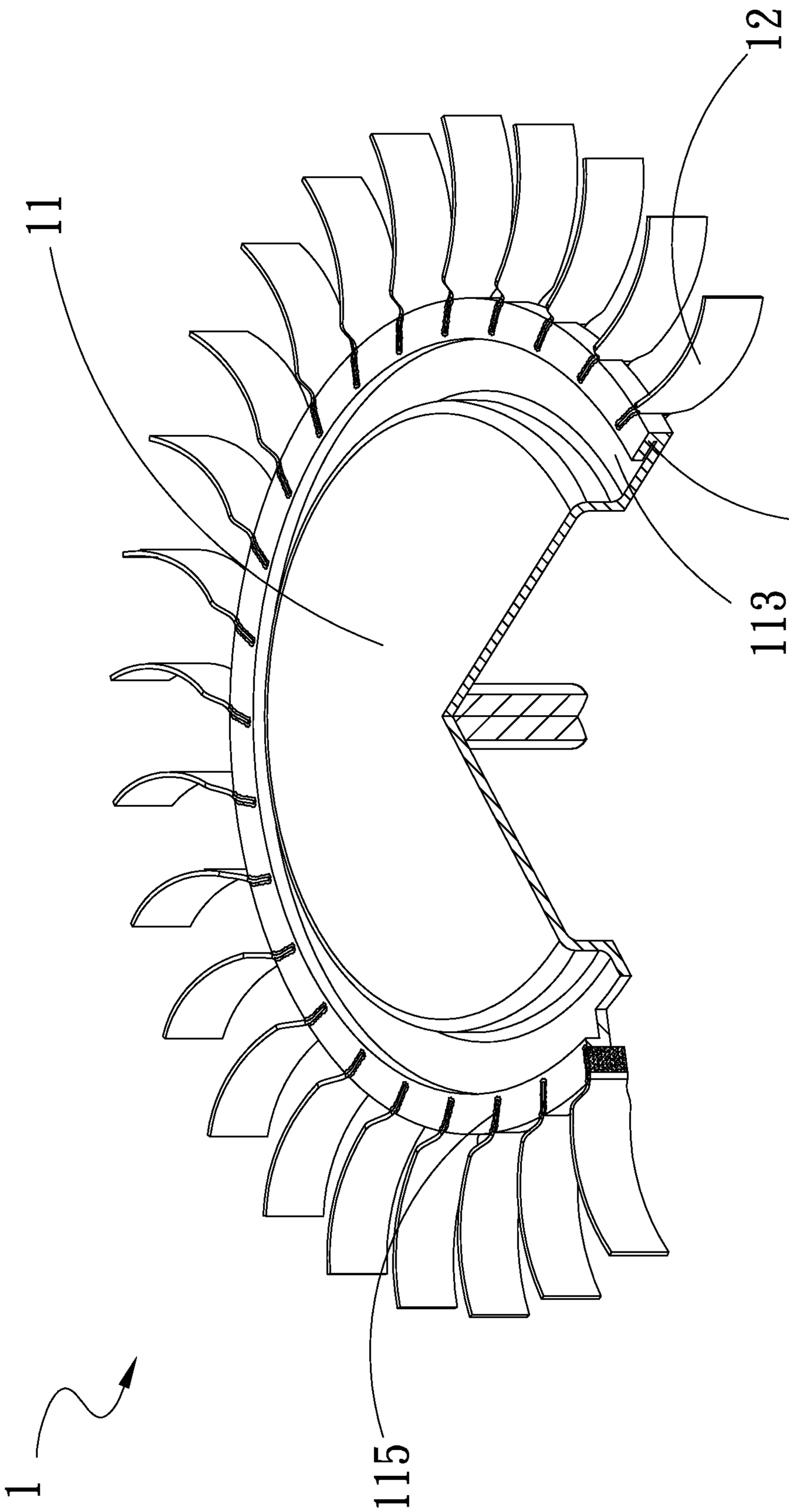

Fig. 7

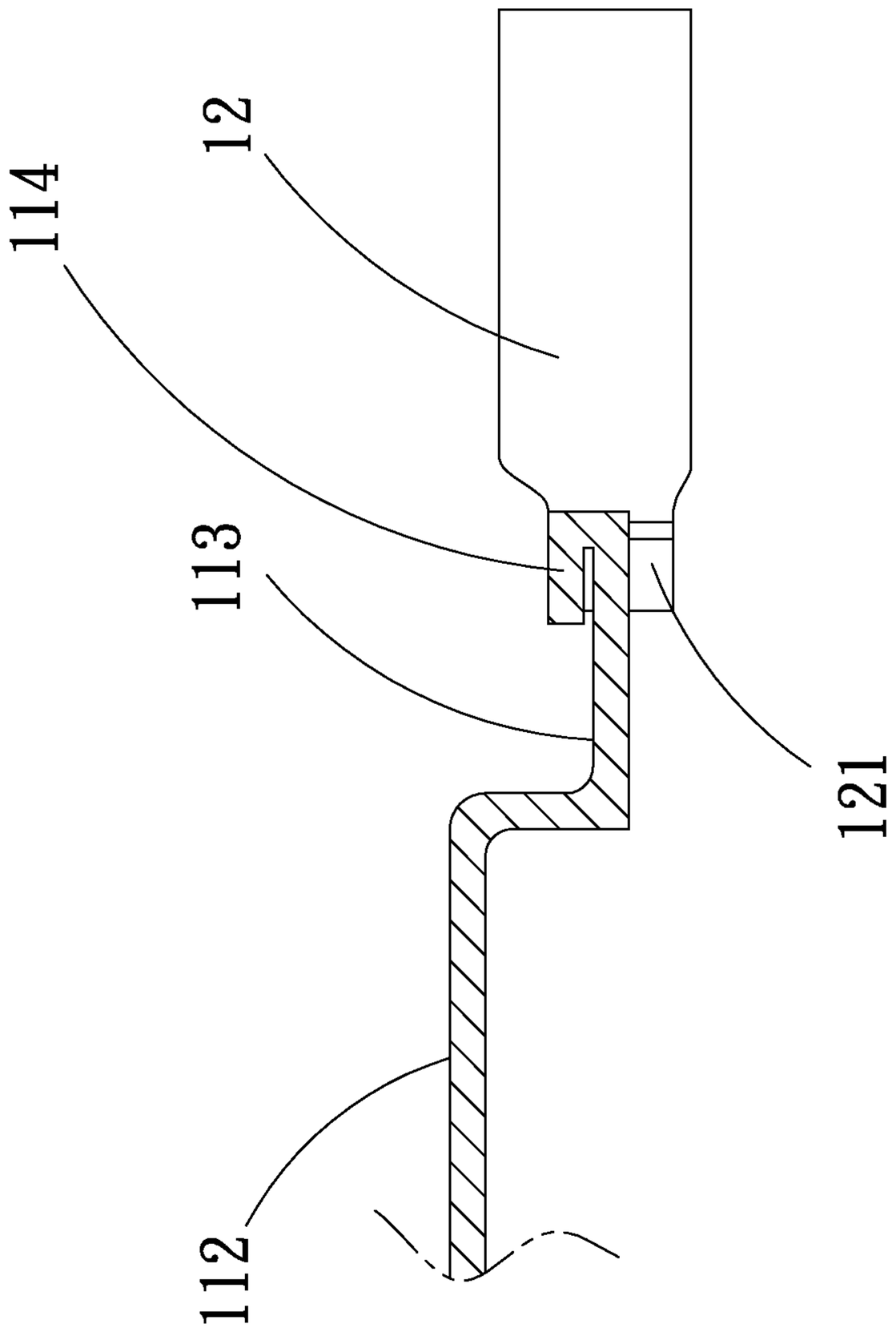

Fig. 8

FAN BLADE WITH IMPROVED STRUCTURE

The present application is a continuation of U.S. patent application Ser. No. 15/063,519, filed on Mar. 8, 2016.

FIELD OF THE INVENTION

The present invention relates to a fan blade with improved structure, and more specifically, to a fan blade with improved structure that can enhance structural strength of thin fan blades of a fan.

BACKGROUND OF THE INVENTION

A fan made of metal or plastic is widely used to remove heat produced by electronic elements. When the blades of the fan are made of plastic by injection technology processing, each blade must have a certain thickness, normally thicker than 0.3 mm, since the fan is unlikely to add the number of blades thereon, or it could break due to high instant stress of wind resistance when operating. Therefore, the inventor has strived to develop a fan blade with an improved structure to overcome the foregoing drawbacks in the prior art fan.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide a fan blade with improved structure that can increase structural strength of thin fan blades of a fan.

Another object of the present invention is to provide a fan blade with improved structure that can provide a better and easy way to connect the hub to the blades and that prevents a fan from imbalanced due to uneven distribution of weight which has been a problem with prior art fans.

To achieve the above and other objects, the fan blade with improved structure provided according to the present invention includes a central circular hub of a predetermined thickness, and a plurality of blades. The hub has a lateral side having two ends, one of which is formed as a top side and the other end is radially extended to form a flange having a plurality of regularly spaced connecting slots located on the periphery of the flange. Each blade has a first end correspondingly engaged in a respective one of the regularly spaced connecting slots and a second end.

With the first end of each blade correspondingly engaged in respective one of the connecting slots located on the periphery of the hub flange, and the blades are correspondingly engaged and fitted in the connecting slots of the hub by laser welding or mechanical processing, the composite fan assembly blade with improved structure offers increased structural strength of such assemblies without the risk of imbalance of the fan due to uneven distribution of weight which has been a problem in prior art fans.

BRIEF DESCRIPTION OF THE DRAWINGS

The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

FIG. **1** is an exploded perspective view of a fan blade with improved structure of the present invention according to a first embodiment thereof;

FIG. **2** is an assembled perspective view of FIG. **1**;

FIGS. **3**A and **3**B show partial views of the fan blade with improved structure before and after a first end of a blade is engaged in respective connecting slot included therein of the present invention according to the first embodiment thereof;

FIG. **4** is a fragmentary sectional view of the present invention according to the first embodiment thereof;

FIG. **5** is an exploded perspective view of the fan blade with improved structure of the present invention according to a second embodiment thereof;

FIGS. **6**A and **6**B show partial views of the fan blade assembly with improved structure before and after a first end of a blade is engaged in a respective connecting slot included therein and two sides next to each connecting slot on a flange before and after downwardly are formed two recesses by two jigs used to fit the first end of each blade in a respective connecting slot included in the present invention according to the second embodiment thereof;

FIGS. **6**C and **6**D are enlarged views of FIGS. **6**A and **6**B;

FIG. **7** shows a sectional perspective view of the fan blade with improved structure of the present invention according to a third embodiment thereof; and

FIG. **8** is a fragmentary sectional view of the present invention according to the third embodiment thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described with some preferred embodiments thereof and by referring to the accompanying drawings. For the purpose of easy to understand, elements that are the same in the preferred embodiments are denoted by the same reference numerals.

Please refer to FIGS. **1**, **2**, which are exploded and assembled perspective views, respectively, of a fan blade assembly with improved structure according to a first embodiment of the present invention, to FIGS. **3**A and **3**B that show the fan blade with improved structure before and after a first end of a blade member is engaged in respective connecting slot included therein according to a first embodiment of the present invention, and to FIG. **4** which is a fragmentary sectional view according to the first embodiment of the present invention. As shown, a fan blade assembly with improved structure **1** includes a hub **11**, a plurality of blade members **12**. The hub **11** has a peripheral side wall **111** extending between a top surface **112** and the other edge of the wall **111** is extended to form an extended flange section **113**. A plurality of connecting slots **115** are located on the periphery of the flange **113**. Also, the peripheral side wall **111**, the top surface **112**, and the extended section or flange **113** of the hub **11** are integrally molded.

In the illustrated first embodiment, the connecting slots **115** are equally spaced on the periphery of the flange **113**. However, in practically implementation, the connecting slots **115** can be non-equally spaced on the periphery of the extended section **113** (not shown).

Each blade member **12** has a first end **121** and an opposite second end **122**, wherein the first end **121** is a connecting end, whereas the second end **122** is a free end. The first end **121** is correspondingly engaged in respective connecting slot **115**. In the illustrated first embodiment, each blade member **12** can be, but not limited to being a, curved-shaped. However, in a practical implementation, each blade **12** can be either curved-shaped or non-curved-shaped.

The first end **121** of each blade member **12** has a height less than or equal to that of the second end **122**. In the

illustrated first embodiment, the height of the first end **121** can be, but not limited to, smaller than that of the second end **122**.

The blade members **12** in the illustrated first embodiment are made of metal by metal stamping or injection technology processing and preferably, each blade **12** has a thickness smaller than 0.15 mm. The hub **11** is also made of metal by die-casting or metal stamping. The blade members **12** are correspondingly engaged in the connecting slots **115** and forming a weld part **117** preferably by laser welding at the junction between the blade members **12** and the hub **11** (see FIG. **3**B). In the illustrated first embodiment, since the blade members **12** and the hub **11** are made of metal, they are fused together to form the weld part **117** preferably by laser welding at the junction between the blade member **12** and the hub **11**, such that the blade members **12** can be fixedly connected to the hub **11** without additional solder or filler to have enhanced structural strength of blade members **12** and to prevent a fan blade assembly from imbalanced due to uneven distribution of weight, a problem with the prior art fans.

With these arrangements, the first ends **121** of the blade members **12** are respectively correspondingly engaged in respective connecting slots **115** on the periphery of the extended flange section **113**, then the first ends **121** are fixedly fitted in the connecting slots **115** by laser welding, such that the blade memebers **12** are fixedly connected to the hub **11**, so as to largely enhance structural strength of blade members **12** and prevent the fan from imbalanced due to uneven distribution of weight caused by the use of solder or filler.

Please refer to FIG. **5**, which is an exploded perspective view of the fan blade assembly with improved structure according to a second embodiment of the present invention, to FIGS. **6**A and **6**B, which show the fan blade with improved structure before and after a first end of a blade member is engaged in respective connecting slot included therein and two sides next to each connecting slot on the flange before and after two recesses are formed downwardly by two jigs to fit the first end of each blade member in a respective connecting slot according to the second embodiment of the present invention, and FIGS. **6**C and D, which are enlarged views of FIGS. **6**A and **6**B. In another possible embodiment, after the first ends **121** of the blade members **12** are fitted in the connecting slots **115**, respectively, two jigs **2** are downwardly or/and upwardly pressed onto the flange **113** at two lateral opposite sides of each connecting slot **115** to insert into the flange **113**, such that two recesses **116** are formed and two opposite internal wall surfaces of the connecting slot **115** are internally squeezed to have the first end **121** of each blade member **12** fitted in respective connecting slot **115** on the extended flange section **113**, so as to fixedly connect the blade members **12** to the hub **11**.

Next refer to FIG. **7**, which shows a sectional perspective view of the fan blade assembly with improved structure according to a third embodiment of the present invention, and FIG. **8**, which is a fragmentary sectional view according to the third embodiment of the present invention.

The third embodiment of the fan blade assembly with improved structure **1** is generally structurally similar to the first embodiment except that, in this third embodiment, the extended flange section **113** of the hub **11** is folded back upon itself to form a connecting portion **114** of double thickness. With the third embodiment, the first ends **121** of the blade members **12** are fitted in the connecting slots **115** by laser welding, providing the same effects as mentioned above.

In conclusion, compared to the prior art fan, the fan blade assembly of the present invention has many advantages as follows: (1) has enhanced structural strength of thin fan blade members; and (2) it provides a more effective way to connect the fan's hub to the blades which can eliminates fan imbalance due to uneven distribution of weight, a problem in prior art fans.

The present invention has been described with some preferred embodiments thereof and it is understood that many changes and modifications in the described embodiments can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

What is claimed is:

1. A fan blade assembly with improved structure, comprising:

a hub including a peripheral wall extending between two ends, one of the two ends presenting a top side, a circular flange section extending radially from the peripheral wall at the other of the two ends, a plurality of connecting slots being disposed in a periphery of the circular flange section, the connecting slots spaced apart from the peripheral wall; and

a plurality of blade members, each of which having a first and an opposite second end;

and the first end correspondingly being engaged in a respective one of the plurality of connecting slots and forming a weld part by laser welding at the junction between the blade members and the hub;

wherein an upper edge of the first end of each of the blade members is flush with a top surface of the circular flange section and a lower edge of the first end of each of the blade members protrudes out from a bottom surface of the circular flange section.

2. The fan blade assembly with improved structure as claimed in claim **1**, wherein the periphery of the circular flange section is upwardly extended toward the top side to form a connecting portion, in which the connecting slots are disposed.

3. The fan blade assembly with improved structure as claimed in claim **2**, wherein the connecting slots are equally or non-equally spaced on the connecting portion.

4. The fan blade assembly with improved structure as claimed in claim **1**, wherein each blade member is curved-shaped or non- curved-shaped.

5. The fan blade assembly with improved structure as claimed in claim **1**, wherein the first end of each blade member has a height dimension smaller than or equal to the second end of each blade member.

6. The fan blade assembly with improved structure as claimed in claim **1**, wherein both the hub and the blade members are made of the same or different materials.

7. The fan blade assembly with improved structure as claimed in claim **1**, wherein each blade member has a thickness smaller than 0.15 mm.

8. The fan blade assembly with improved structure as claimed in claim **1**, wherein the peripheral wall, the top side, and the circular flange section of the hub are integrally molded.

9. The fan blade assembly with improved structure as claimed in claim **1**, wherein two lateral opposite sides next of each connecting slot on the circular flange section are downwardly formed pair of recesses formed by two jigs being inserted, such that two opposite internal wall surfaces

of each connecting slot are internally squeezed to fit the first end of each blade member in a respective connecting slot.

* * * * *